Landings and Age Compositions for Pacific Cod *(Gadus macrocephalus)* from the Strait of Georgia and the Strait of Juan de Fuca, 1945-84

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LANDINGS AND AGE COMPOSITIONS FOR PACIFIC COD (*Gadus macrocephalus*) FROM THE STRAIT OF GEORGIA AND THE STRAIT OF JUAN DE FUCA, 1945-84

by

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ABSTRACT

Foucher, R. P. and M. G. Giudici. 1985. Landings and age compositions for Pacific cod (Gadus macrocephalus) from the Strait of Georgia and the Strait of Juan de Fuca, 1945-84. Can. Data Rep. Fish. Aquat. Sci. 517: 32 p.

Trawl landings (t) (1945-84) and numbers landed-at-age (1950-84) are reported for Pacific cod, by quarter-year, for the important minor statistical areas (14, 17, 18, 19 and 20) within Georgia Strait and vicinity (Area 4B). Age-frequencies were determined from length-frequency samples of landings using a computerized method. The time series of age-frequencies are incomplete because of small or no landings or lack of sampling. An inventory is included containing numbers of Pacific cod sampled from the landings, by month and minor area.

Key words: landings, age composition, Pacific cod, Strait of Georgia

RÉSUMÉ

Foucher, R. P. and M. G. Giudici. 1985. Landings and age compositions for Pacific cod (Gadus macrocephalus) from the Strait of Georgia and the Strait of Juan de Fuca, 1945-84. Can. Data Rep. Fish. Aquat. Sci. 517: 32 p.

Les débarquements (t) des chalutiers (1945-1984) et les quantités réparties selon l'âge (1950-1984) sont présentés pour la morue du Pacifique, par trimestre, pour les petites zones statistiques importantes (14, 17, 18, 19 et 20) du détroit de Georgie et des environs (zone 4B). On a déterminé, au moyen d'une méthode informatisée, les fréquences des âges à partir de la fréquence des longueurs dans des échantillons prélevés sur les débarquements. La série chronologique des fréquences des âges est incomplète soit parce qu'il n'y a pas eu de débarquements ou que ceux-ci ont été faibles, ou bien qu'il n'y a pas eu d'échantillonnage. Un inventaire indique les quantités de morue du Pacifique qui ont été prélevées sur les débarquements, par mois et par petite zone.

Mots-clés: débarquements, composition par âge, détroit de Georgie

INTRODUCTION

Pacific cod (Gadus macrocephalus) in British Columbia waters are noted for their short lifespan, rapid growth and variations in year-class abundance.

Fundamental to a study of population dynamics for a fish stock are landing statistics and age composition of landings. For Pacific cod in British Columbia waters such "data packages" have been completed for the important offshore grounds--Hecate Strait (Areas 5C & 5D) (Foucher and Jacobs 1981); Queen Charlotte Sound (Areas 5A & 5B) (Foucher and Westrheim 1983); and off the southwest coast of Vancouver Island (Areas 3C & 3D) (Westrheim and Foucher 1983) (Fig. 1).

This report, covering Georgia and Juan de Fuca straits (Area 4B) (Fig. 2), contains records of Pacific cod landings (t) during 1945-84 and numbers landed-at-age during 1950-84. No length-frequency samples were collected prior to 1950. The availability of samples from 1950-84 was dependent on the frequency of landings and resources for sampling - thus there are many gaps in the time series. Effort data are not included because of the complications of increasing efficiency and the presence of other species. A study is currently underway to standardize trawling effort.

MATERIALS AND METHODS

LANDING STATISTICS

Methods

Landing statistics were compiled by quarter-year and minor statistical area from the Pacific Biological Station's computerized groundfish data base for 1954-84. Earlier records (1945-53) were extracted from a series of reports by Thomson and Yates (1960, 1961a, 1961b, 1961c, 1962). The fishery in Area 4B was entirely by Canadian vessels with no participation by U.S. vessels as in other areas of B.C.

AGE COMPOSITION

Materials

Length-frequency samples were collected by port liaison officers from Canadian trawl landings. Although samples in later years sometimes

included data by sex, the sexes were combined for consistency with earlier years. There is little evidence of an appreciable difference in mean length-at-age by sex for the important age-classes. All cod were measured to the nearest centimeter of fork length.

There is a fishery, limited to the first quarter, for spawning cod off Nanoose Bay, a portion of MSA 17 (Fig. 2). These fish appear here only for a short time each year to spawn and the area has been closed to trawling in other quarter-years since 1947 (Westrheim 1980). Since they likely consist of only mature cod, samples from Nanoose Bay were separated from those from the remainder of MSA 17 for age determination.

Methods

Age compositions were derived using a computer program, modified for use with Pacific cod length-frequency data by Foucher and Fournier (1982) from the generalized method of Schnute and Fournier (1980).

Samples were grouped by month and MSA (MSA 14, 17, 18, 19 and 20) except in MSA 17 January-March where samples from Nanoose Bay were separated from other localities in MSA 17.

Age composition in numbers landed by age (N_i), were calculated for each month sampled as follows:

$$N_i = (W/w)\ (n)\ (p_i)$$

where W = Canadian total landings (t),
w = sample weight (t),
n = numbers sampled,
and p_i = proportion of fish at age i.

The monthly N_i's were then summed by quarter-year for this report. In the case of MSA 17 for the first quarter-year, where Nanoose samples were aged separately from the remainder of the area, Canadian total landings for Nanoose were determined by extrapolating Nanoose interviewed landings by MSA 17 total landings over MSA 17 interviewed landings. The same procedure was used for the remaining portion of MSA 17.

Where only one or two months of a quarter-year were sampled the numbers landed at age by quarter-year (N_{iq}) were derived using:

$$N_{iq} = (N_{im})\ (W_q/W_m)$$

where N_{im} = numbers landed at age i in months m,
m = months in which samples were collected,
W_q = weight landed in quarter q,
and W_m = weight landed in months m.

Where there were no samples for a quarter-year no attempt has been made in this report to make a substitution. There are thus many gaps in the time series.

RESULTS

The cumulative landings of Pacific cod for 1945-84 by quarter-year and MSA are contained in Table 1. MSAs 14, 17, 18, 19 and 20 comprised 95% of the landings. The highest production was from MSA 18 (33%) which produced an average 243 t per year. Quarters 1 and 4 comprised 78% of the Area 4B landings. Only in MSA 20 were landings distributed relatively uniformly (22-28%) among quarter-years. Landings were highest in quarter 1 in all MSAs except 19 where they were highest in quarter 4.

Total Pacific cod landings by quarter-year are contained in Table 2 for Area 4B and in Tables 3-7 for MSAs 14, 17, 18, 19 and 20 respectively. Interviewed landings for quarter 1 from MSA 17, by ground--Nanoose Bay and "other", are contained in Table 8.

Numbers of Pacific cod landed-at-age by quarter-year during 1950-84 for MSAs 14, 17 (Nanoose and other), 18, 19 and 20 are contained in Tables 9-14 respectively.

Appendix tables 1-6 provide an inventory of the number of fish sampled by month for which age compositions were subsequently determined.

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TABLES

Table 1. Cumulative landings (t) of Pacific cod from Area 4B, by MSA, by quarter-year, 1945-84.

MSA		Quarter-year 1	2	3	4	Total	%
14	(t)	1696	512	306	916	3430	12
	%	49	15	9	27	100	
17	(t)	3556	410	67	588	4621	16
	%	77	9	1	13	100	
18	(t)	5858	1104	276	2499	9737	33
	%	60	11	3	26	100	
19	(t)	1381	402	1541	3774	7098	25
	%	19	6	22	53	100	
20	(t)	714	627	619	557	2517	9
	%	28	25	25	22	100	
Other[a]	(t)	552	432	94	433	1511	5
	%	36	29	6	29	100	
4B total	(t)	13,757	3487	2903	8767	28,914	100
	%	48	12	10	30	100	

[a]Other = MSA's 12, 13, 15, 16, 28, 29, and landings for which the MSA is unknown

Table 2. Annual Pacific cod landings (t) from Area 4B by quarter-year 1945-84.

Year	Quarter-year 1	2	3	4	Total
1945	306	74	11	145	536
46	463	8	2	160	633
47	51	28	19	30	128
48	53	25	7	24	109
49	83	41	18	109	251
1950	210	42	45	132	429
51	382	139	51	185	757
52	478	81	60	182	801
53	375	74	137	253	839
54	704	172	61	292	1229
1955	567	120	59	188	934
56	315	67	47	130	559
57	349	62	17	161	589
58	429	55	11	127	622
59	640	77	57	251	1025
1960	438	109	22	166	735
61	236	57	21	94	408
62	248	57	34	138	477
63	219	183	19	245	666
64	423	74	22	191	710
1965	242	53	15	165	475
66	111	36	17	132	296
67	288	13	28	141	470
68	157	55	27	110	349
69	107	79	32	169	387
1970	228	85	28	161	502
71	459	92	29	157	737
72	374	90	34	132	630
73	287	97	6	51	441
74	327	71	85	197	680
1975	302	97	145	447	991
76	294	117	237	279	927
77	315	163	137	533	1148
78	541	131	239	460	1371
79	552	88	95	467	1202
1980	558	146	411	495	1610
81	680	168	251	618	1717
82	476	168	73	294	1011
83	300	74	198	331	903
84	190	119	96	225	630

Table 3. Annual Pacific cod landings (t) from MSA 14, by quarter-year 1945-84.

Year	Quarter-year 1	2	3	4	Total
1945	25	10	T[a]	1	36
46	13	2	1	7	23
47	7	14	2	2	25
48	6	2	2	5	15
49	6	12	4	5	27
1950	4	1	17	27	49
51	42	72	15	23	152
52	30	18	20	39	107
53	12	10	110	48	180
54	216	78	32	60	386
1955	160	16	16	18	210
56	87	9	19	23	138
57	90	26	2	44	162
58	54	1	T	14	69
59	88	2	32	26	148
1960	98	6	1	10	115
61	37	32	0	16	85
62	38	1	0	17	56
63	26	5	0	48	79
64	63	T	0	9	72
1965	26	T	0	6	32
66	13	T	0	8	21
67	21	0	0	11	32
68	9	0	0	8	17
69	9	0	0	19	28
1970	11	0	0	51	62
71	25	4	0	30	59
72	22	0	13	58	93
73	36	58	0	10	104
74	34	14	0	28	76
1975	39	8	0	26	73
76	51	T	6	33	90
77	31	34	T	24	89
78	71	35	0	6	112
79	42	0	T	48	90
1980	32	24	1	44	101
81	45	2	0	43	90
82	39	6	7	13	65
83	25	3	0	4	32
84	13	7	6	4	30

[a]T = trace = <0.5t

Table 4. Annual Pacific cod landings (t) from MSA 17, by quarter-year 1945-84.

Year	Quarter-year 1	2	3	4	Total
1945	22	21	1	8	52
46	98	3	1	8	110
47	9	5	0	9	23
48	22	0	4	13	39
49	14	0	11	80	105
1950	119	28	9	22	178
51	115	13	1	8	137
52	223	10	9	10	252
53	165	13	8	26	212
54	128	18	1	21	168
1955	32	9	2	12	55
56	95	19	9	13	136
57	77	7	0	16	100
58	201	13	1	11	226
59	197	18	0	36	251
1960	182	23	T[a]	8	213
61	86	5	T	5	96
62	63	1	0	2	66
63	94	50	5	22	171
64	96	20	0	11	127
1965	31	2	T	6	39
66	8	3	0	6	17
67	142	2	0	20	164
68	101	6	0	19	126
69	32	8	0	9	49
1970	80	3	0	22	105
71	309	8	1	21	339
72	270	12	T	1	283
73	125	7	T	8	140
74	124	12	0	5	141
1975	68	2	0	41	111
76	36	11	1	17	65
77	27	14	2	33	76
78	46	7	0	7	60
79	39	3	T	10	52
1980	19	13	T	1	33
81	11	1	0	11	23
82	21	1	1	3	26
83	8	12	T	5	25
84	21	7	0	2	30

[a] T = trace = <0.5t

Table 5. Annual Pacific cod landings (t) from MSA 18, by quarter-year 1945-84.

Year	Quarter-year 1	2	3	4	Total
1945	228	2	1	116	347
46	349	0	1	124	474
47	22	T[a]	2	11	35
48	21	6	0	2	29
49	49	9	T	15	73
1950	82	6	12	73	173
51	193	38	15	132	378
52	195	34	9	108	346
53	165	31	14	171	381
54	338	31	6	177	552
1955	352	55	8	139	554
56	111	15	T	61	187
57	138	6	1	64	209
58	97	10	1	31	139
59	292	12	1	35	340
1960	135	11	T	60	206
61	93	2	1	32	128
62	122	6	1	59	188
63	82	84	1	112	279
64	207	24	1	66	298
1965	135	11	1	25	172
66	51	0	1	52	104
67	87	6	10	47	150
68	30	16	3	57	106
69	53	7	9	38	107
1970	118	27	9	38	192
71	101	37	2	69	209
72	67	31	4	51	153
73	121	22	4	32	179
74	163	39	12	33	247
1975	121	55	10	119	305
76	189	97	12	57	349
77	202	105	27	74	408
78	289	40	19	45	393
79	192	39	6	31	268
1980	222	41	24	35	322
81	189	89	14	42	334
82	58	37	9	22	126
83	66	18	5	21	110
84	33	5	20	29	87

[a]T = trace = <0.5t

Table 6. Annual Pacific cod landings (t) from MSA 19, by quarter-year 1945-84.

Year	Quarter-year 1	2	3	4	Total
1945	2	0	0	0	2
46	0	0	0	0	0
47	0	0	0	0	0
48	0	0	0	0	0
49	0	0	0	0	0
1950	T[a]	0	0	0	T
51	14	2	0	0	16
52	1	0	0	5	6
53	1	0	0	2	3
54	17	4	0	7	28
1955	11	2	0	4	17
56	4	2	0	5	11
57	2	1	0	7	10
58	32	1	0	34	67
59	55	5	1	132	193
1960	11	2	2	77	92
61	11	0	11	18	40
62	17	10	5	26	58
63	2	9	T	34	45
64	40	0	T	66	106
1965	15	T	T	107	122
66	11	0	1	19	31
67	4	0	T	33	37
68	9	0	6	15	30
69	4	2	2	70	78
1970	9	0	0	34	43
71	9	4	0	12	25
72	1	0	0	12	13
73	0	0	0	0	0
74	0	0	52	117	169
1975	57	0	84	253	394
76	4	0	206	138	348
77	5	1	100	386	492
78	98	39	173	336	646
79	108	36	74	325	543
1980	68	37	374	394	873
81	200	48	209	500	957
82	304	93	31	189	617
83	169	25	160	268	622
84	86	79	50	149	364

[a] T = trace = <0.5t

Table 7. Annual Pacific cod landings (t) from MSA 20, by quarter-year 1945-84.

Year	Quarter-year 1	2	3	4	Total
1945	T[a]	0	0	0	T
46	0	0	0	1	1
47	2	0	11	3	16
48	0	T	1	1	2
49	0	T	2	5	7
1950	T	1	7	3	11
51	2	2	19	6	29
52	0	9	19	8	36
53	2	6	2	5	15
54	0	2	14	6	22
1955	1	5	29	4	39
56	T	2	16	8	26
57	T	0	5	9	14
58	0	24	8	22	54
59	0	16	24	5	45
1960	4	56	18	7	85
61	0	15	8	16	39
62	5	29	28	22	84
63	7	26	14	19	66
64	1	15	20	24	60
1965	17	34	13	14	78
66	20	29	16	28	93
67	T	2	16	16	34
68	T	25	17	6	48
69	2	55	21	25	103
1970	0	46	21	14	81
71	9	36	26	23	94
72	12	46	17	7	82
73	0	2	2	0	4
74	0	3	4	12	19
1975	0	29	43	6	78
76	T	4	4	39	47
77	2	3	10	1	16
78	24	4	45	47	120
79	159	8	15	23	205
1980	199	10	11	11	231
81	144	27	21	13	205
82	46	30	26	47	149
83	19	17	31	25	92
84	37	9	15	26	87

[a] T = trace = <0.5t

Table 8. Pacific cod landings (t) (interviewed) from Nanoose Bay and all other localities in MSA 17 combined for quarter 1, 1954-84.

Year	Nanoose	Other
1954	102	19
55	26	3
56	76	7
57	59	9
58	166	3
59	158	3
1960	129	1
61	78	1
62	43	T[a]
63	50	33
64	62	8
1965	28	1
66	T	7
67	126	10
68	89	10
69	17	14
1970	41	10
71	286	6
72	249	20
73	67	2
74	101	4
1975	25	28
76	5	22
77	T	13
78	6	12
79	14	1
1980	T	T
81	T	T
82	T	T
83	0	0
84	0	T
Total	2003	247
%	89	11

[a]T = trace = <0.5.

Table 9. Canada total numbers of Pacific cod landed, by age, by quarter-year, from MSA 14, 1950-84.

Year [a]	Age 1	2	3	4	5	6	7	8	9	10
January-March										
1954	0	4740	22278	14523	7507	2403	1115	77	51	0
1955	0	5317	27980	17274	2856	1089	321	110	0	0
1956	0	2215	16564	6819	2645	33	143	0	0	0
1957	0	7337	16754	8506	3152	552	108	199	0	0
1958	0	4834	2066	1058	182	107	0	0	17	0
1959	0	7320	11065	845	550	121	0	0	46	0
1960	0	1855	11352	7532	459	656	41	95	0	0
1961	0	3860	4793	2454	1059	248	139	0	0	0
1962	0	356	2865	3833	854	264	16	16	0	0
1963	0	2898	1832	1006	60	174	0	0	18	0
1964	0	3132	9269	2661	678	317	91	0	0	0
1965	0	1283	2919	757	474	347	0	0	0	0
1966	0	3341	1288	749	244	51	0	0	0	0
1967	0	4534	3356	1757	102	59	0	0	0	0
1968	0	826	582	144	0	0	0	0	0	0
1969	0	760	605	55	23	0	0	0	0	0
1970	0	1215	1146	153	163	0	0	0	0	0
1971	0	4132	1190	1505	365	27	8	0	0	0
1972	0	1706	3579	1380	0	0	0	0	0	0
1973	0	544	2227	3570	774	1071	247	68	0	0
1975	0	5607	3888	2539	979	79	132	0	0	0
1976	0	2561	4304	5168	2393	859	294	157	0	0
1977	0	1016	1470	833	240	161	30	0	0	0
1978	0	2939	12003	2703	1554	220	137	0	0	0
1979	0	6277	6109	4866	994	187	66	0	0	0
1980	0	3213	422	912	0	37	0	0	0	0
1982	0	3423	323	199	24	16	0	0	0	0
April-June										
1952	0	351	3319	36	209	32	0	0	0	0
1953	0	445	558	386	76	0	0	0	0	0
1955	0	1596	2260	1556	204	62	0	0	0	0
1956	0	966	1530	593	90	29	0	0	0	0
1959	0	940	45	0	0	0	0	0	0	0
1960	0	1663	657	159	0	0	0	0	0	0
1961	0	3511	2127	282	72	0	0	0	0	0
1963	0	2455	665	271	0	0	0	0	0	0
1973	0	6422	6353	4111	2907	397	245	0	0	0
1977	0	6862	4312	1354	618	0	0	0	0	0
1978	0	5478	4522	2582	524	0	0	0	0	0
1980	0	2686	140	99	63	0	0	0	0	0

Table 9 (continued).

Year	Age 1	2	3	4	5	6	7	8	9	10
July-September										
1952	0	1843	1337	398	0	36	0	0	0	0
1953	0	16699	4889	2558	150	777	0	0	0	0
1954	0	2496	6078	2520	442	310	24	72	0	0
1956	0	2723	2227	856	101	93	20	23	0	0
1957	0	284	45	86	4	7	0	0	0	0
1959	0	22460	372	0	0	0	0	0	0	0
October-December										
1959	0	6699	137	0	0	0	0	0	0	0
1961	44	317	390	1293	163	90	0	0	0	0
1962	2496	1466	2151	692	22	123	0	0	0	0
1963	3023	11059	893	517	172	0	0	0	0	0
1969	4528	1258	1010	557	52	27	14	0	0	0
1970	1559	15201	3482	2119	75	113	0	0	0	0
1971	0	5402	1905	533	0	0	0	0	0	0
1972	581	13236	1595	1117	392	67	0	0	0	0
1974	188	4303	2104	1432	228	223	75	0	0	0
1975	0	2410	578	940	28	114	0	0	0	0
1977	0	1333	860	262	48	20	0	0	0	20

[a]No samples for missing years.

Table 10. Canada total numbers of Pacific cod landed, by age, from Nanoose Bay (MSA 17) during January-March, 1954-84.

	Age									
Year[a]	1	2	3	4	5	6	7	8	9	10
1954	0	6156	29074	8024	863	768	0	0	0	0
1955	0	395	5189	1753	1048	180	0	26	0	0
1956	0	5100	21844	8828	1521	165	133	42	0	0
1957	0	812	20229	3147	1347	224	0	0	0	0
1958	0	10762	44797	14169	1926	925	0	0	0	0
1959	0	1288	75124	2859	2188	306	0	0	0	0
1960	0	8853	30986	19078	3266	80	85	0	0	0
1961	0	6938	21506	5161	549	292	0	0	0	0
1962	0	7097	14218	2310	144	289	0	0	0	0
1963	0	7212	15169	2313	271	344	0	0	0	0
1964	0	6935	15851	5444	2215	541	72	98	0	26
1965	0	1334	8628	1863	414	170	50	0	0	0
1967	0	1166	50053	3763	386	55	0	0	0	0
1968	0	1088	31187	7417	1129	142	0	0	0	0
1969	0	2484	3453	1423	234	88	0	0	0	0
1970	0	9025	5598	4692	979	469	173	32	0	0
1971	0	30897	57487	37166	4858	947	0	0	131	0
1972	0	3629	65338	27303	6361	2651	186	0	0	12
1973	0	8723	21068	11500	557	2346	111	217	25	25
1974	0	10715	9516	12405	4016	785	430	178	0	0
1975	0	2662	4695	1340	425	65	55	0	0	0
1978	0	331	4013	479	250	25	0	0	0	0
1979	0	2724	8287	1578	571	73	92	59	0	0

[a]No samples for 1966, 1980-84.

Table 11. Canada total numbers of Pacific cod landed, by age, by quarter-year, from localities other than Nanoose Bay in MSA 17, 1954-84.

	Age									
Year[a]	1	2	3	4	5	6	7	8	9	10
January-March										
1958	0	1238	266	51	30	10	8	0	0	0
1963	49	2700	1245	1948	55	166	0	0	0	0
1967	0	7990	1063	105	0	0	0	0	0	0
1968	0	1052	128	67	5	4	0	3	0	0
1969	31	1246	88	112	7	7	4	0	0	0
1970	260	14502	177	1092	305	0	0	0	0	0
1971	0	2472	454	71	56	15	19	0	0	0
1975	0	23511	495	625	14	109	0	0	81	55
1976	0	2889	2357	711	229	0	0	0	0	0
1977	0	750	1970	1526	420	30	59	109	39	35
April-June										
1962	0	118	59	5	5	0	0	0	0	0
1963	0	10949	9864	1911	142	732	0	0	0	0
1966	0	888	62	117	48	18	0	3	0	0
1967	0	1048	237	40	0	0	0	0	0	0
1969	319	2886	65	286	25	22	18	0	0	0
July-September										
1958	0	392	40	48	4	3	0	0	0	0
1963	165	1277	254	159	65	0	0	0	0	0
October-December										
1954	250	3159	858	574	60	60	30	0	0	0
1962	355	440	88	8	0	9	0	0	0	0
1963	548	1950	135	192	14	32	0	0	0	0
1964	187	616	227	122	41	5	8	0	0	0
1966	2176	110	155	40	13	13	0	0	0	0
1967	3930	1893	677	314	0	0	0	0	0	21
1968	5353	1564	1009	207	141	0	0	0	0	0
1969	2178	2836	767	159	157	26	0	0	0	0
1970	0	13020	2457	1624	118	132	0	14	0	0
1971	0	3058	602	1026	207	131	30	0	0	0

[a]No samples for missing years.

Table 12. Canada total numbers of Pacific cod landed, by age, by quarter-year, from MSA 18, 1951-84.

	Age									
Year	1	2	3	4	5	6	7	8	9	10
January-March										
1951	0	60248	8864	10192	4102	1424	378	237	38	0
1953	0	24281	7435	4290	3228	66	126	432	0	0
1954	0	55383	26412	4966	4960	1297	358	683	0	0
1955	0	13256	66166	33972	10392	4116	1231	309	155	52
1956	0	33257	13615	6017	2286	614	390	275	0	0
1957	0	28773	20940	3632	1177	0	235	0	0	0
1958	0	6310	3742	1197	256	116	0	0	0	0
1959	0	47798	73750	11460	1895	814	337	0	34	0
1960	0	25450	18067	9016	1387	509	68	130	0	0
1961	0	1356	11268	2248	3983	4289	1201	1018	152	422
1962	0	16224	24088	5480	2995	285	183	41	61	0
1964	0	43091	20536	9517	1896	269	86	0	0	0
1965	0	7029	6219	2300	389	259	0	0	0	0
1966	0	14190	1588	980	135	0	0	0	0	0
1967	0	22286	1361	656	0	0	0	0	0	0
1968	0	5594	645	197	145	0	0	0	0	0
1969	0	8172	3104	3225	595	35	88	0	0	0
1970	0	50003	5897	4383	1277	403	0	62	62	0
1971	0	47835	12356	5496	983	518	76	131	0	32
1972	0	9551	3961	924	147	0	0	88	0	0
1973	0	6794	1986	1426	42	317	0	0	0	0
1974	0	22542	7204	2278	524	447	0	0	0	0
1975	0	36481	147	0	111	111	0	0	0	0
1976	0	10551	28842	1952	419	714	36	0	0	107
1977	0	68430	20281	6345	1739	674	0	0	0	0
1978	0	44814	38348	9896	4936	1824	304	434	174	0
1979	0	28482	16866	9685	4764	266	0	0	212	0
April-June										
1951	0	8968	2085	2822	1317	329	157	0	0	0
1953	0	1217	290	182	19	21	37	0	0	0
1960	0	1988	1824	837	164	0	0	0	0	0
1963	0	26315	8247	5824	1658	468	0	0	0	0
1970	0	10565	2071	1056	209	0	0	0	0	0
1971	0	16109	3273	2212	484	72	69	0	0	0
1974	0	8620	4867	88	689	132	264	0	0	0
1975	0	32141	871	402	0	0	101	0	0	0
1978	0	1437	14129	1546	655	327	0	0	0	91
July-September										
1952	0	28	220	110	24	7	0	0	0	0

Table 12. (continued).

Year	Age 1	2	3	4	5	6	7	8	9	10
October-December										
1951	200	6031	3069	3002	614	307	120	0	0	0
1952	556	692	7469	68	1385	919	261	0	0	0
1954	708	8883	4866	1910	617	265	0	0	0	0
1955	118	2574	2386	314	292	24	116	0	0	0
1958	1495	8390	1250	465	304	0	23	0	0	0
1960	1637	13062	3146	3560	111	0	0	42	0	0
1965	113	527	230	172	12	22	0	0	0	0
1966	16207	1106	959	166	0	0	0	0	0	0
1967	8249	2711	596	35	93	0	0	0	0	0
1970	4360	1601	1033	607	284	0	0	0	0	0
1971	15470	10849	2807	1580	279	167	0	0	0	0
1975	5504	34404	2018	2766	468	622	0	0	0	0

[a] No samples for missing years.

Table 13. Canada total numbers of Pacific cod landed, by age, by quarter-year, from MSA 19, 1959-84.

	Age								
Year[a]	1	2	3	4	5	6	7	8	9
January-March									
1978	0	6047	21130	6012	1387	996	0	0	0
1979	0	16895	4696	944	94	566	401	0	0
1980	0	15693	1922	2570	188	355	0	167	0
1981	0	95244	16239	1382	576	1728	0	0	0
1982	0	15400	82800	6223	527	527	0	0	0
1983	0	32040	3000	1667	333	0	0	0	0
April-June									
1979	0	3860	5124	1712	369	67	0	56	0
1980	0	17383	2713	1280	65	152	109	0	0
July-September									
1960	0	37	125	167	53	0	0	0	0
1961	0	4470	1118	272	53	0	0	0	0
1974	0	946	6955	6274	1610	614	116	83	0
1976	0	12360	29318	5261	919	2911	51	0	255
1977	0	15026	5435	8312	2622	320	256	0	0
1978	1248	22677	27163	5594	5057	1415	551	405	0
1979	0	11941	3699	1428	0	0	0	138	0
1980	318	138144	17741	19866	3009	2504	477	660	64
1981	0	95227	33003	4558	2918	1304	1214	0	0
1983	2838	43075	3212	9361	3697	127	1307	64	0
October-December									
1959	0	1338	31793	3038	0	0	0	0	0
1960	0	6743	3688	2529	211	0	0	0	0
1964	952	16627	1806	337	119	0	0	0	0
1965	125	32829	3009	516	231	0	0	0	0
1970	1705	11655	2351	970	168	0	0	0	0
1975	0	31859	4112	5861	4349	614	473	0	0
1976	674	19910	13873	4035	455	834	0	52	0
1977	8414	153051	17615	14663	2503	1198	0	211	0
1978	36280	52801	22101	2571	385	321	256	0	0
1979	43736	60280	23634	8974	1747	1645	871	416	161
1980	17051	34629	352	5684	879	0	0	0	0
1981	17478	297841	19408	4911	2819	0	0	0	0
1982	81615	10955	27335	2329	228	319	319	0	0
1983	82821	51649	11397	9141	50	748	0	0	0
1984	47581	7192	2129	633	0	0	0	0	0

[a]No samples for missing years.

Table 14. Canada total numbers of Pacific cod landed, by age, by quarter-year, from MSA 20, 1951-84.

Year[a]	Age 1	2	3	4	5	6	7	8	9	10
January-March										
1966	0	356	1737	1018	403	47	36	0	0	0
1978	0	3	153	140	47	30	0	0	0	0
1979	0	15	2544	3171	1110	445	91	83	91	0
1980	0	133	18535	20479	8445	5520	2104	184	0	0
1982	0	1026	7663	5285	1057	155	357	0	0	0
April-June										
1960	0	226	12728	5327	465	82	0	0	0	0
1961	0	48	251	124	7	7	3	0	0	0
1962	0	1137	3172	1054	28	127	0	0	0	0
1975	0	1816	2512	1152	418	304	127	0	0	0
July-September										
1951	0	3083	4689	648	77	99	70	17	0	0
1954	0	0	4652	256	146	25	0	22	0	22
1956	0	384	2379	915	186	0	12	0	0	0
1958	0	215	1523	179	76	0	0	0	0	0
1959	0	6480	14569	257	150	0	0	0	0	0
1969	0	659	1475	559	270	25	107	25	0	19
October-December										
1951	19	870	1056	171	11	11	0	0	0	0
1958	0	676	3867	29	190	0	0	0	0	0
1961	18	565	1102	133	0	0	0	0	0	0
1962	296	4441	2573	1002	303	54	0	0	0	0
1965	88	1249	1217	322	50	0	0	0	0	0
1966	0	2795	4520	1564	1100	111	0	0	0	0
1971	0	2296	2687	805	30	65	36	0	0	0

[a]No samples for missing years.

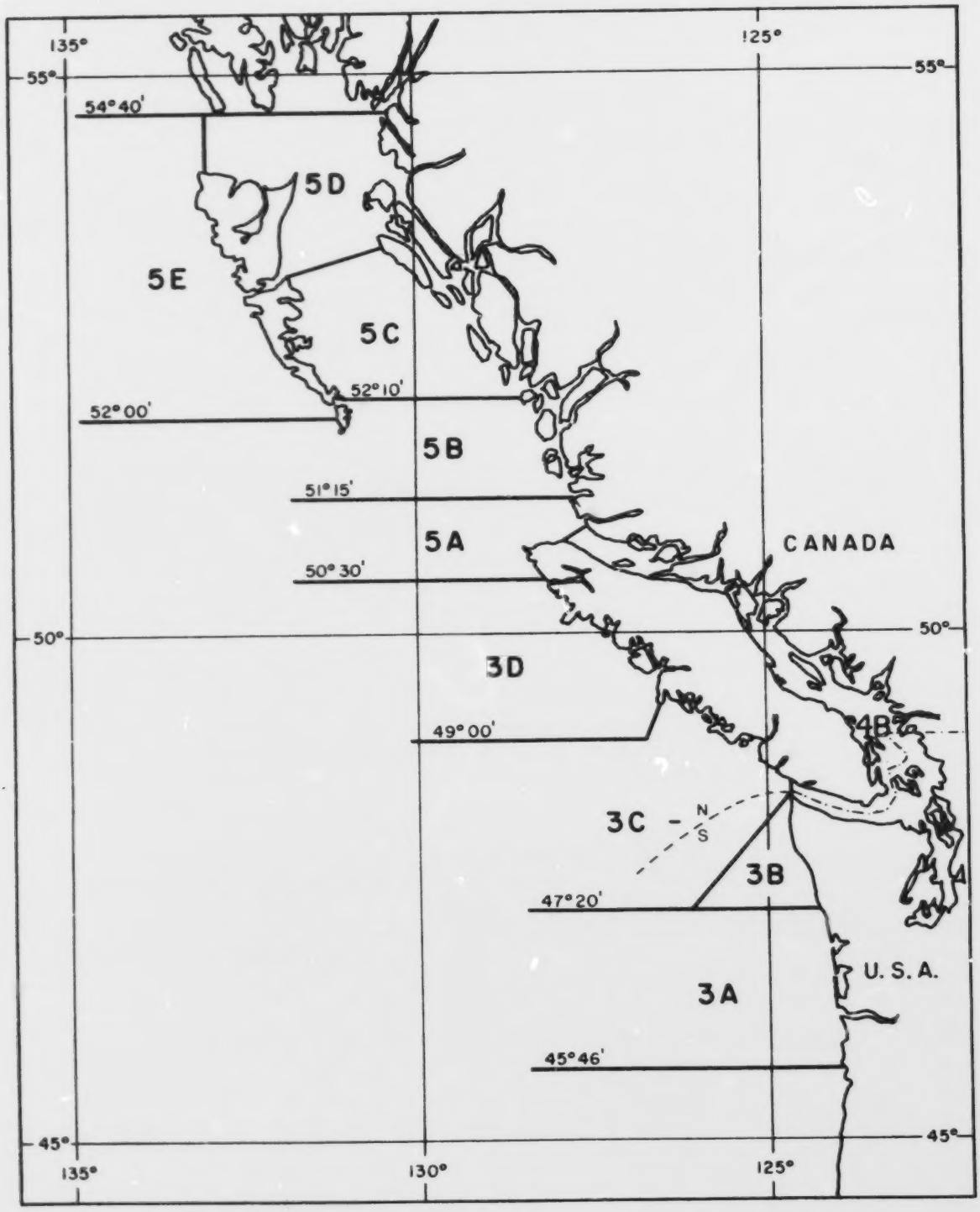

Figure 1. International statistical areas for the Canada-U.S. groundfish fisheries.

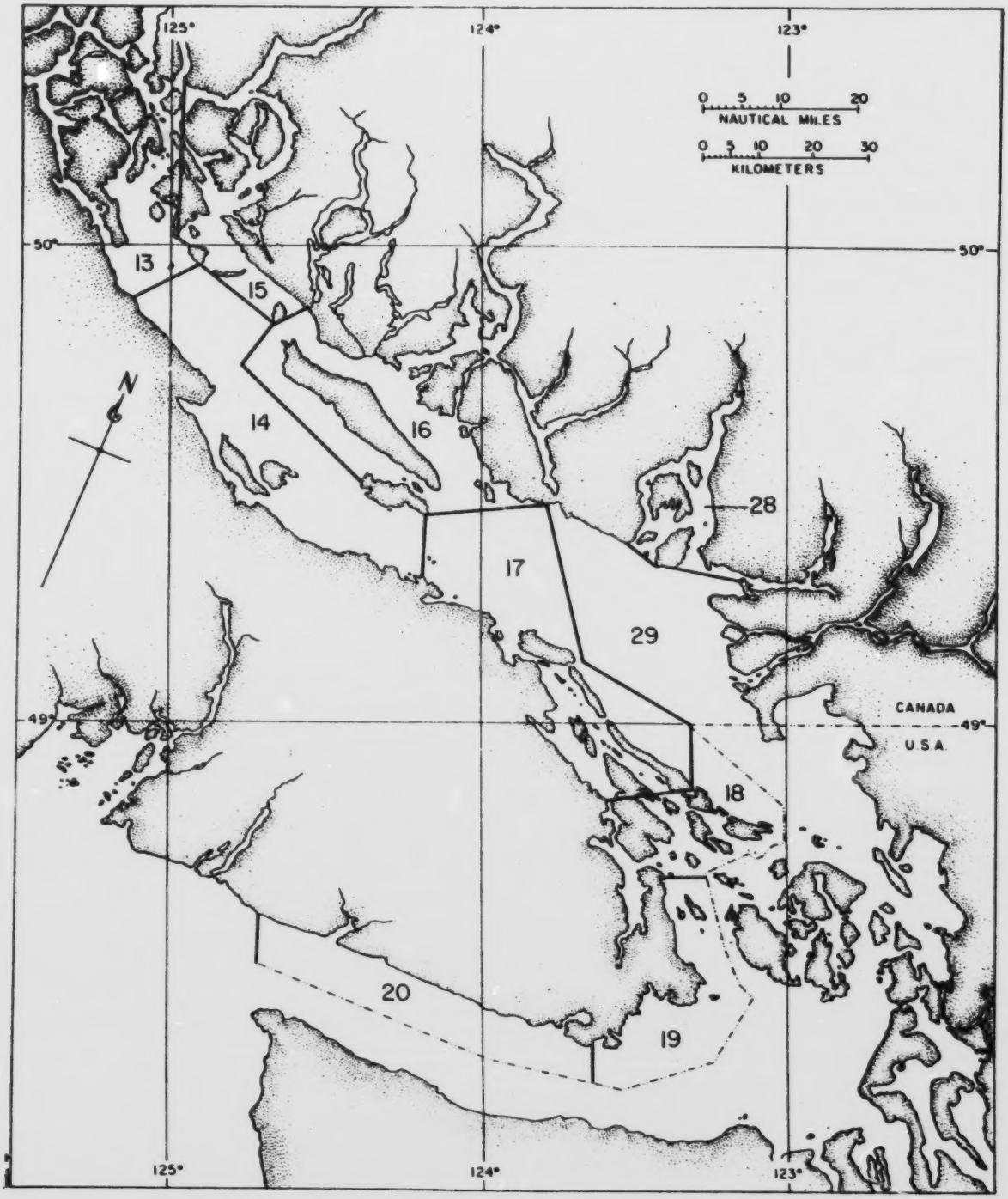

Figure 2. Minor statistical areas in major area 4B.

Appendix table 1. Inventory of number of Pacific cod sampled, by month, by year, from MSA 14, 1950-84[a].

	Month											
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1950	-	-	-	-	-	-	-	460	-	-	-	-
51	-	-	-	-	-	-	-	-	-	-	-	-
52	-	-	-	-	-	335	202	-	-	-	-	-
53	-	-	-	-	99	103	-	-	93	-	-	-
54	273	-	602	-	-	-	174	-	-	-	-	-
1955	344	409	383	-	-	170	-	-	-	-	-	-
56	-	87	176	-	-	154	339	-	120	-	-	-
57	94	214	360	-	-	-	-	-	326	-	-	-
58	566	-	-	-	-	-	-	-	-	-	-	-
59	194	-	186	-	-	235	553	-	182	166	-	-
1960	262	144	-	-	-	417	-	-	-	-	-	-
61	-	134	154	-	907	-	-	-	-	-	-	98
62	489	58	-	-	-	-	-	-	-	-	285	162
63	381	-	-	331	-	-	-	-	-	-	444	-
64	215	-	214	-	-	-	-	-	-	-	-	-
1965	-	84	-	-	-	-	-	-	-	-	-	-
66	-	217	-	-	-	-	-	-	-	-	-	-
67	476	181	-	-	-	-	-	-	-	-	-	-
68	210	-	-	-	-	-	-	-	-	-	-	-
69	-	63	-	-	-	-	-	-	-	341	-	155
1970	298	-	-	-	-	-	-	-	-	229	880	228
71	176	809	-	-	-	-	-	-	-	-	221	-
72	-	157	-	-	-	-	-	-	-	-	318	155
73	96	124	-	820	342	-	-	-	-	-	-	-
74	-	-	-	-	-	-	164	-	-	-	303	287
1975	-	-	567	-	236	-	-	-	-	-	133	-
76	468	190	-	-	-	-	-	-	-	-	-	-
77	-	-	120	-	-	120	-	-	-	120	-	-
78	-	278	440	-	-	175	-	-	-	-	-	-
79	-	177	267	-	-	-	-	-	-	-	-	-
1980	120	-	-	120	-	-	-	-	-	-	-	-
81	-	-	-	-	-	-	-	-	-	-	-	-
82	-	-	290	-	-	-	-	-	-	-	-	-

[a]No samples in 1983 or 1984

Appendix table 2. Inventory of the number of Pacific cod sampled by month[a], by year from Nanoose Bay (MSA 17), 1950-84[b].

Year	Month		
	Jan	Feb	Mar
1950	-	-	82
51	-	44	655
52	-	-	251
53	-	237	328
54	-	214	496
1955	-	319	-
56	-	101	510
57	-	352	203
58	-	536	367
59	-	453	413
1960	-	313	755
61	-	171	891
62	-	-	1045
63	-	586	824
64	-	659	582
1965	-	237	223
66	-	-	-
67	-	216	774
68	-	227	1238
69	-	108	423
1970	-	232	852
71	-	702	1029
72	-	705	757
73	-	361	729
74	-	278	760
1975	-	415	-
76	-	-	-
77	-	-	-
78	-	-	452
79	-	187	160

[a]No fishery in April-December
[b]No samples in 1980-84

Appendix table 3. Inventory of number of Pacific cod sampled, by month, by year, from localities other than Nanoose Bay in MSA 17, 1950-84[a].

Year	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1951	-	158	464	-	-	-	-	-	-	-	-	-
52	-	120	-	-	-	-	-	-	-	-	-	-
53	-	-	-	-	-	-	79	-	-	-	-	-
54	-	-	-	-	-	-	-	-	-	-	279	-
1955	-	-	-	-	-	-	-	-	-	-	-	-
56	-	-	-	-	-	-	-	-	-	-	-	-
57	-	-	-	-	-	-	-	-	-	-	-	-
58	-	226	-	-	-	-	-	-	156	-	-	-
59	-	-	-	-	-	-	-	-	-	-	-	-
1960	-	-	-	-	-	-	-	-	-	-	-	-
61	-	-	-	-	-	-	-	-	-	-	-	-
62	-	-	-	-	-	102	-	-	-	-	-	293
63	-	-	236	353	-	-	-	-	186	-	340	-
64	-	-	-	-	-	-	-	-	-	-	244	-
1965	-	-	-	-	-	-	-	-	-	-	-	-
66	-	-	-	157	-	150	-	-	-	-	285	-
67	447	307	-	353	-	-	-	-	-	-	320	-
68	488	-	-	-	-	-	-	-	-	-	287	-
69	-	-	610	285	-	-	-	-	-	-	291	214
1970	316	229	-	-	-	-	-	-	-	-	412	1008
71	308	-	-	-	-	-	-	-	-	-	346	-
72	-	-	-	-	-	-	-	-	-	-	-	-
73	-	-	-	-	-	-	-	-	-	-	-	-
74	-	-	-	-	-	-	-	-	-	-	-	-
1975	466	-	396	-	-	-	-	-	-	-	-	-
76	95	-	-	-	-	-	-	-	-	-	-	-
77	133	-	-	-	-	-	-	-	-	-	-	-

[a]No samples in 1950 or 1978-84

Appendix table 4. Inventory of number of Pacific cod sampled, by month, by year, from MSA 18, 1950-84[a].

Year	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1951	-	1055	1534	309	-	-	-	-	-	-	507	-
52	-	-	-	-	-	-	137	-	-	-	120	-
53	240	-	102	-	91	-	-	-	-	-	-	-
54	380	-	279	-	-	-	-	-	-	196	756	-
1955	1198	519	359	-	-	-	-	-	-	-	283	96
56	188	415	183	-	-	-	-	-	-	-	-	-
57	-	228	212	-	-	-	-	-	-	-	-	-
58	-	-	396	-	-	-	-	-	-	-	146	301
59	668	374	507	-	-	-	-	-	-	-	-	-
1960	352	580	453	287	-	-	-	-	-	-	122	325
61	140	334	-	-	-	-	-	-	-	-	-	-
62	622	315	-	-	-	-	-	-	-	-	-	-
63	-	-	-	913	-	-	-	-	-	-	-	-
64	-	1135	295	-	-	-	-	-	-	-	-	-
1965	-	-	253	-	-	-	-	-	-	147	-	-
66	-	373	-	-	-	-	-	-	-	-	-	315
67	284	-	-	-	-	-	-	-	-	-	389	-
68	137	-	-	-	-	-	-	-	-	-	-	-
69	-	205	269	-	-	-	-	-	-	-	-	-
1970	621	201	-	258	-	-	-	-	-	-	-	254
71	1134	514	579	921	199	-	-	-	-	-	246	315
72	-	169	-	-	-	-	-	-	-	-	-	-
73	-	-	160	-	-	-	-	-	-	-	-	-
74	-	226	188	166	-	-	-	-	-	-	-	-
1975	-	-	321	321	-	-	-	-	-	-	116	89
76	762	-	110	-	-	-	-	-	-	-	-	-
77	-	240	119	-	-	-	-	-	-	-	-	-
78	362	120	-	198	-	-	-	-	-	-	-	-
79	-	122	222	-	-	-	-	-	-	-	-	-

[a]No samples in 1950 or 1980-84

Appendix table 5. Inventory of number of Pacific cod sampled, by month, by year, from MSA 19, 1950-84[a].

Year	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1959	-	-	-	-	-	-	-	-	-	-	166	-
60	-	-	-	-	-	-	-	-	91	289	-	-
61	-	-	-	-	-	-	-	-	236	-	-	-
62	-	-	-	-	-	-	-	-	-	-	-	-
63	-	-	-	-	-	-	-	-	-	-	-	-
64	-	-	-	-	-	-	-	-	-	-	-	187
1965	-	-	-	-	-	-	-	-	-	986	558	-
66	-	-	-	-	-	-	-	-	-	-	-	-
67	-	-	-	-	-	-	-	-	-	-	-	-
68	-	-	-	-	-	-	-	-	-	-	-	-
69	-	-	-	-	-	-	-	-	-	-	-	-
1970	-	-	-	-	-	-	-	-	-	332	409	-
71	-	-	-	-	-	-	-	-	-	-	-	-
72	-	-	-	-	-	-	-	-	-	-	-	-
73	-	-	-	-	-	-	-	-	-	-	-	-
74	-	-	-	-	-	-	-	-	211	-	-	-
1975	-	-	-	-	-	-	-	-	-	440	-	-
76	-	-	-	-	-	-	-	-	247	120	-	120
77	-	-	-	-	-	-	-	240	-	374	720	238
78	240	-	-	-	-	-	-	120	535	-	643	120
79	-	117	-	185	-	-	-	-	120	308	355	120
1980	120	-	-	272	-	-	-	823	240	-	-	120
81	120	-	-	-	-	-	120	120	120	120	360	119
82	240	-	-	-	-	-	-	-	-	-	263	203
83	192	-	-	-	-	-	-	452	257	193	256	-
84	-	-	-	-	-	-	-	-	-	400	-	-

[a]No samples in 1950-58

Appendix table 6. Inventory of number of Pacific cod sampled, by month, by year, from MSA 20, 1950-84[a].

Year	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1951	-	-	-	-	-	-	-	271	173	318	-	-
52	-	-	-	-	-	-	-	-	-	-	-	-
53	-	-	-	-	-	-	-	-	-	-	-	-
54	-	-	-	-	-	-	-	112	148	-	-	-
1955	-	-	-	-	-	-	-	-	-	-	-	-
56	-	-	-	-	-	-	-	-	291	-	-	-
57	-	-	-	-	-	-	-	-	-	-	-	-
58	-	-	-	-	-	-	164	-	-	25	-	-
59	-	-	-	-	-	-	177	-	-	-	-	-
1960	-	-	-	-	186	217	-	-	-	-	-	-
61	-	-	-	-	325	-	-	-	-	-	96	-
62	-	-	-	-	87	-	-	-	-	389	82	-
63	-	-	-	-	-	-	-	-	-	-	-	-
64	-	-	-	-	-	-	-	-	-	-	-	-
1965	-	-	-	-	-	-	-	-	-	-	170	-
66	393	-	-	-	-	-	-	-	-	189	-	-
67	-	-	-	-	-	-	-	-	-	-	-	-
68	-	-	-	-	-	-	-	-	-	-	-	-
69	-	-	-	-	-	-	-	164	-	-	-	-
1970	-	-	-	-	-	-	-	-	-	-	-	-
71	-	-	-	-	-	-	-	-	-	165	-	-
72	-	-	-	-	-	-	-	-	-	-	-	-
73	-	-	-	-	-	-	-	-	-	-	-	-
74	-	-	-	-	-	-	-	-	-	-	-	-
1975	-	-	-	-	-	138	-	-	-	-	-	-
76	-	-	-	-	-	-	-	-	-	-	-	-
77	-	-	-	-	-	-	-	-	-	-	-	-
78	-	120	-	-	-	-	-	-	-	-	-	-
79	-	405	-	-	-	-	-	-	-	-	-	-
1980	124	121	-	-	-	-	-	-	-	-	-	-
81	-	-	-	-	-	-	-	-	-	-	-	-
82	-	-	278	-	-	-	-	-	-	-	-	-

[a]No samples in 1950 or 1983-84